Usability and Software Architecture

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What it is: We provide a method for assessing a design, or proposed design, of software architecture with respect to its ability to support necessary usability features. Our two dozen *architecturally-sensitive usability scenarios* commonly occur in complex software systems, but are very difficult to implement late in development if the architecture is not designed to support them from the beginning.

Features: We provide *usability-supporting architectural patterns* (USAPs) that include an architecturally-sensitive usability scenario, an analysis of the potential benefits to the project that decides to support the scenario, a list of the responsibilities that the software must fulfill to support the scenarios, and an example architecture design that supports the scenario.

Benefits: When software engineers use our USAPs, they consider three times as many of the necessary responsibilities in their architecture design than if they do not have the USAPs available. (This benefit has been documented in a controlled experiment with software engineers appearing in ICSE 2005.) Assuming the architecture design is carried through to the final implementation, the result for the end-user of the software system is a more usable system that increases users' efficiency, their ability to learn and problem-solve, and user satisfaction.

Successes: USAPs were used to design the MERBoard collaborative worktool user at JPL on the 2003 Mars mission. Our assessment of the initial software architecture design and subsequent design advice, led to many changes, an easier implementation, and a more usable system.

Contexts in which it is best used: Based on fundamental aspects of human behavior and software design that are common to all complex software systems, USAPs are appropriate for any software system that has a human-in-the-loop. It is best applied when the software developers have will develop large portions of the system themselves, but can also be used as a method to aid in the selection of COTS components.

Compare with alternative known products or technologies. To our knowledge, there is no other method for analyzing a software architecture for usability.

What will a successful collaboration look like?

a. **What will you as the technology provider do?** We will consult with your development team at the architecture design stage of the project. This typically takes the form of a two-day architecture assessment meeting at your site and follow-on telephone calls as needed.
b. **What should the development team do?** Prior to the collaboration, the NASA software development team should communicate with us to determine whether its application is a good one for USAPs.
c. **How will you, as technology provider, work together with the development team to ensure a successful collaboration?** Any initial architecture designs should be sent to us to review before the architecture assessment meeting. During the meeting, the technology providers and the development team (including the project's software architects, software developers, user advocates, and end users, if possible) judge the relevance of the architecturally-sensitive usability scenarios for the project, walk through the proposed architecture, and assign responsibilities to software components to support the important scenarios. After the meeting, additional issues that arise in the design of the architecture are typically addressed via teleconference.